Motorising the Peco Turntable - a different approach

Motorised model railway turntables seem to fall into two main groups: a) converted Peco turntables with motor attachments; b) expensive manufacturers' turntables such as Fleischmann or Kato, etc. All the Peco conversions seem to be noisy although inexpensive. Atlas make a turntable that can be motorised inexpensively but it is American in looks and certainly not quiet in operation.

The turntable described below is an inexpensive conversion of a Peco kit (NB-55) that is both silent in operation and inexpensive, with accurate rail-alignment control. The ‘OO’ version will probably work with this idea but has not been tried. The cost of the conversion parts needs not to be more than £20 and shopping around could reduce this. The downside, if there is one, is the need to invest a little time learning some new techniques if the full flexibility in tailoring its operation to any one particular layout's requirements is to be accomplished.

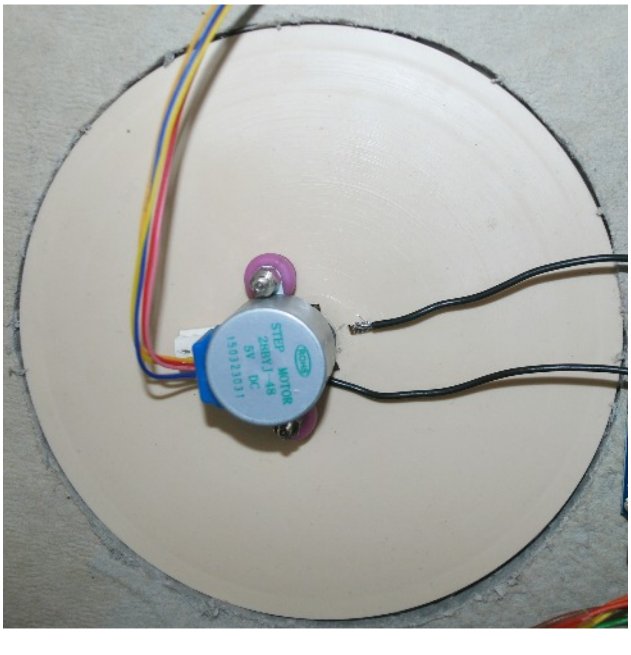
This whole idea is offered as a ‘starter-for-ten’ insofar as it can surely be developed further and the intention is to start the ball rolling to see what ideas, improvements, etc. come forth from other enthusiasts.

The design described allows for one in/out road connecting the turntable to the rest of the layout, four storage roads and the ability to turn a loco. However, any combination of tracks that can be physically placed around the turntable is possible. The extra components to add to the Peco turntable comprise :

- Arduino development board (£10 or less)
- 28BYJ-48 Stepper Motor + ULN2003 Driver Test Module Board for Arduino (£5)
- 2 x press-to-make buttons or 1 x ON/OFF/ON SPDT Toggle switch (Maplin Code: FH07H £2.69)
- 1 x 50k pre-set potentiometer (Maplins Code: N54BR £0.69)
- Use of a computer (Windows PC, Mac or Linux) with usb port.

Note that the use of a computer is for setting up the Arduino and tailoring it to the user's needs only. Once setup, the computer is unnecessary for the operation of the turntable.
The general design works for both analogue (DC) and DCC layouts although DCC users might benefit from the use of an auto-reverser such as the Digitrax AR1.

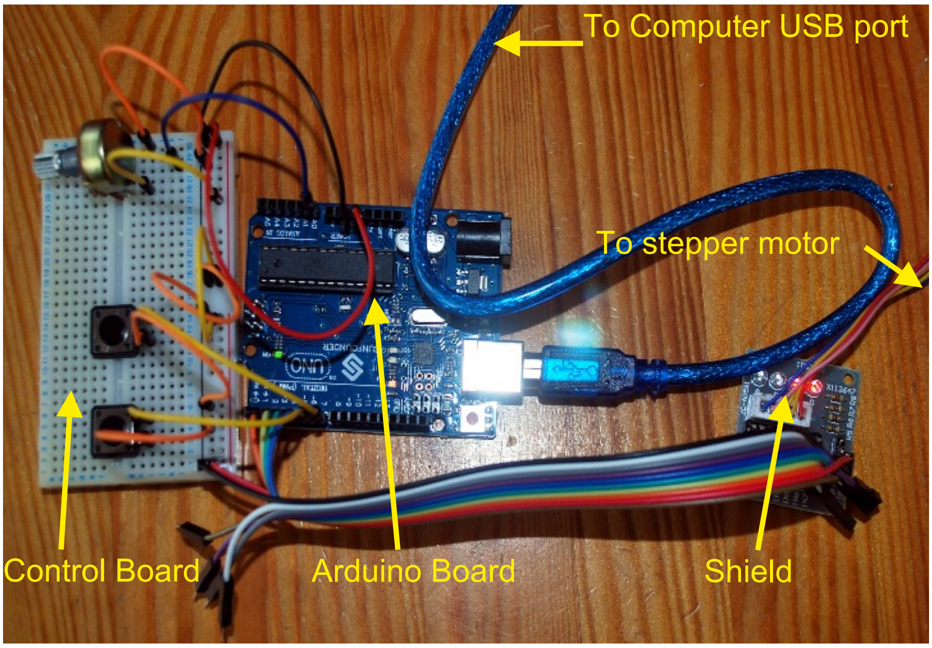
Start by fitting the stepper motor to the turntable. Nothing too technical here but the stepper motor shaft diameter is slightly too large for the hole in the turntable's axle hole, so careful drilling out is necessary. Bolting in the motor is down to the modeller's ingenuity and skill. In this prototype, parts from a defunct PC CD drive were utilised (these CD/DVD drives contain a wealth of useful bits, motors, gears, screws, etc.).

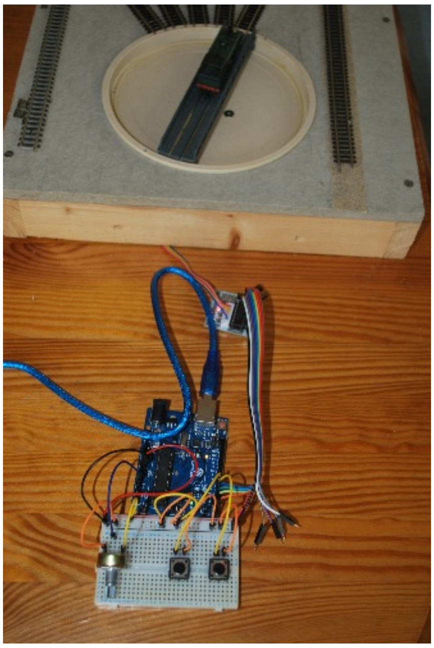


Development Phase

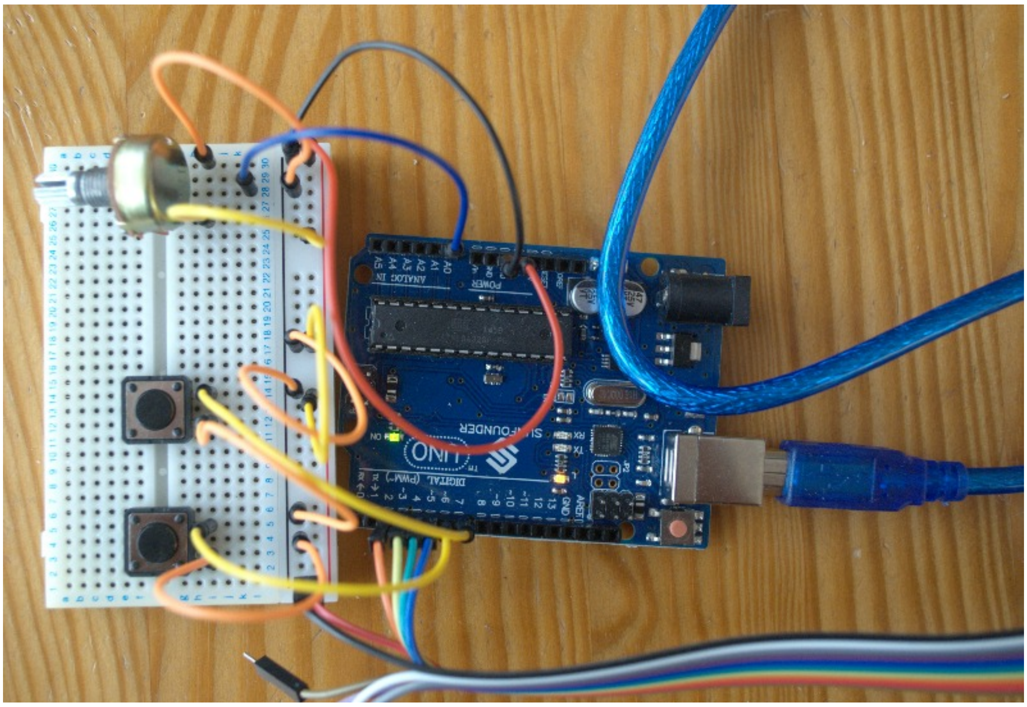
After purchasing an Arduino development kit I was amazed at the multitude of pieces that came with the main Arduino development board. There was the stepper motor (used in this project), servo, relay, prototype boards, infra-red sensor and remote control, lots of buttons, LED's, connection wires, and loads more besides.

It was necessary to download and install the Arduino development software onto a PC (Mac and Linux available too). After all the 'toys' were played with for a while, the stepper motor was attached to the Peco turntable kit and development of the turntable control software was commenced. Starting from scratch, it took a while……….!





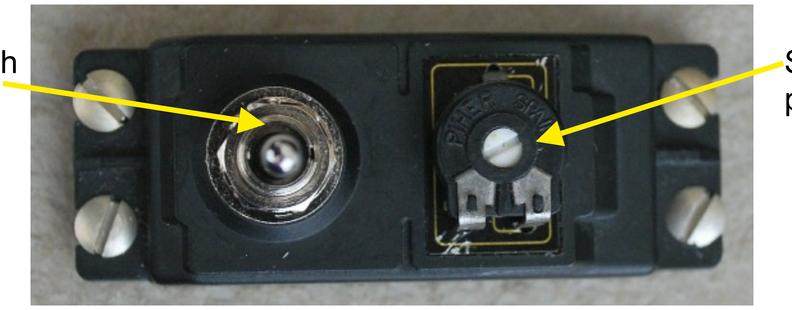
After much experimentation, a final design was decided upon using two buttons to control the clockwise and anti-clockwise rotation of the turntable. It was considered necessary to add a speed controller to ensure that a realistic speed of movement could be established. The program (or 'sketch' as it is called) was written accordingly to operate these functions and uploaded to the micro-controller at the heart of the Arduino board.



In final implementation, the two push buttons were substituted by an On-Off-On Single Pole Double Throw switch. This type of switch defaults to a centre-off position and is operated by holding it in either of the 'On' positions.

Making the Control Panel

The buttons (or toggle switch) will control the clockwise/anti-clockwise rotation). The Preset potentiometer is used to set the turntable rotation speed to the user’s own preference.
Make up a small control panel to hold the push-buttons (or toggle-switch) and speed controller preset.

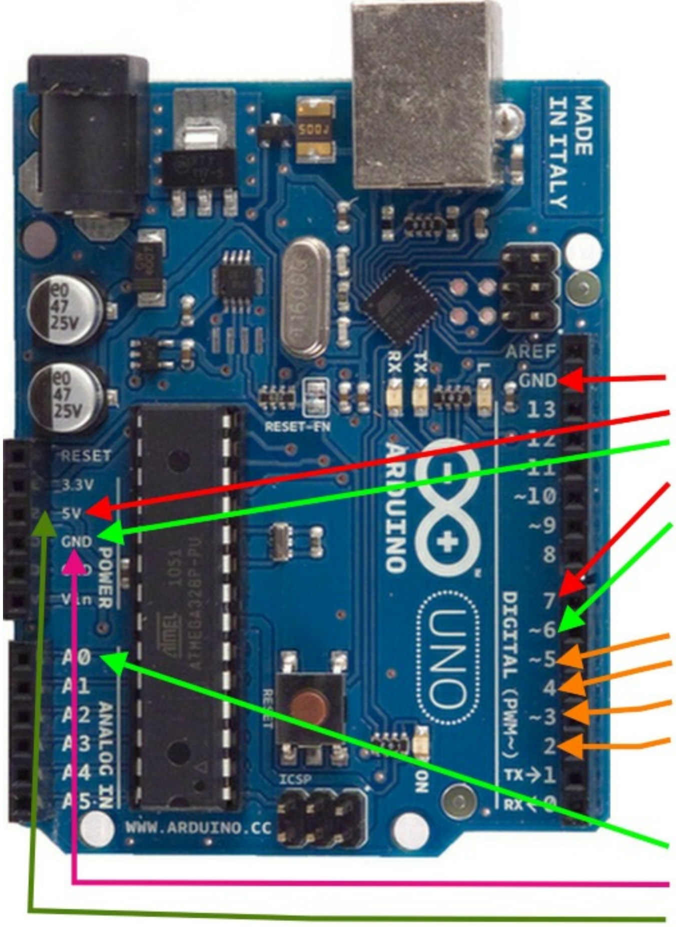


Toggle Switch

Speed preset potentiometer

Rotate Clockwise ⟵ OFF ⟶ Rotate Anti-Clockwise

Wiring up to the Arduino and Shield

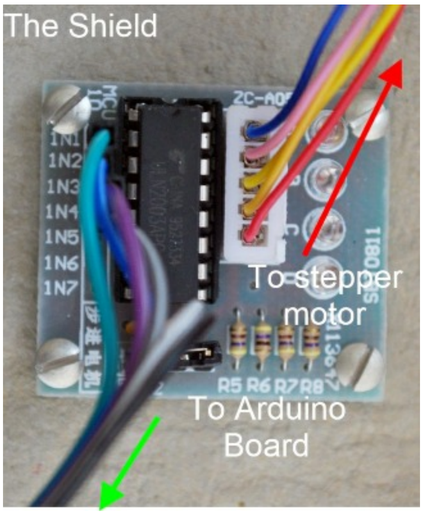


The stepper motor comes with a shield that protects the Arduino microcontroller for the higher current required by the stepper motor.

Connections to the Arduino board:
Shield power -ve to GND
Shield power +ve to 5v
Toggle switch centre connection to GND
Toggle Switch outer connection 1 to 7
Toggle Switch outer connection 2 to 6

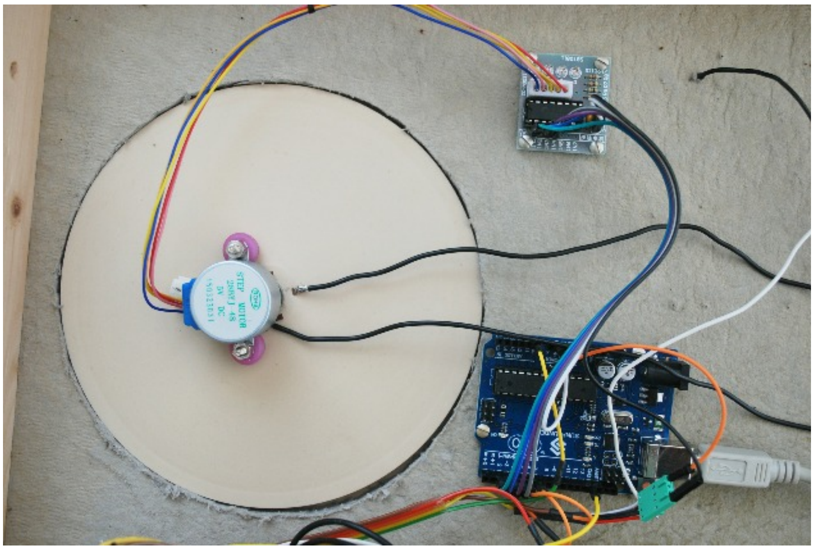
Shield connections (stepper motor windings)
Shield 1N4 to 5
Shield 1N3 to 4
Shield 1N2 to 3
Shield 1N1 to 2

Preset speed controller potentiometer
Preset centre (wiper) connection to A0
Preset outer connection 1 to GND
Preset outer connection 2 to 5v (Note: combine to a single connection with the Shield 5v +ve.

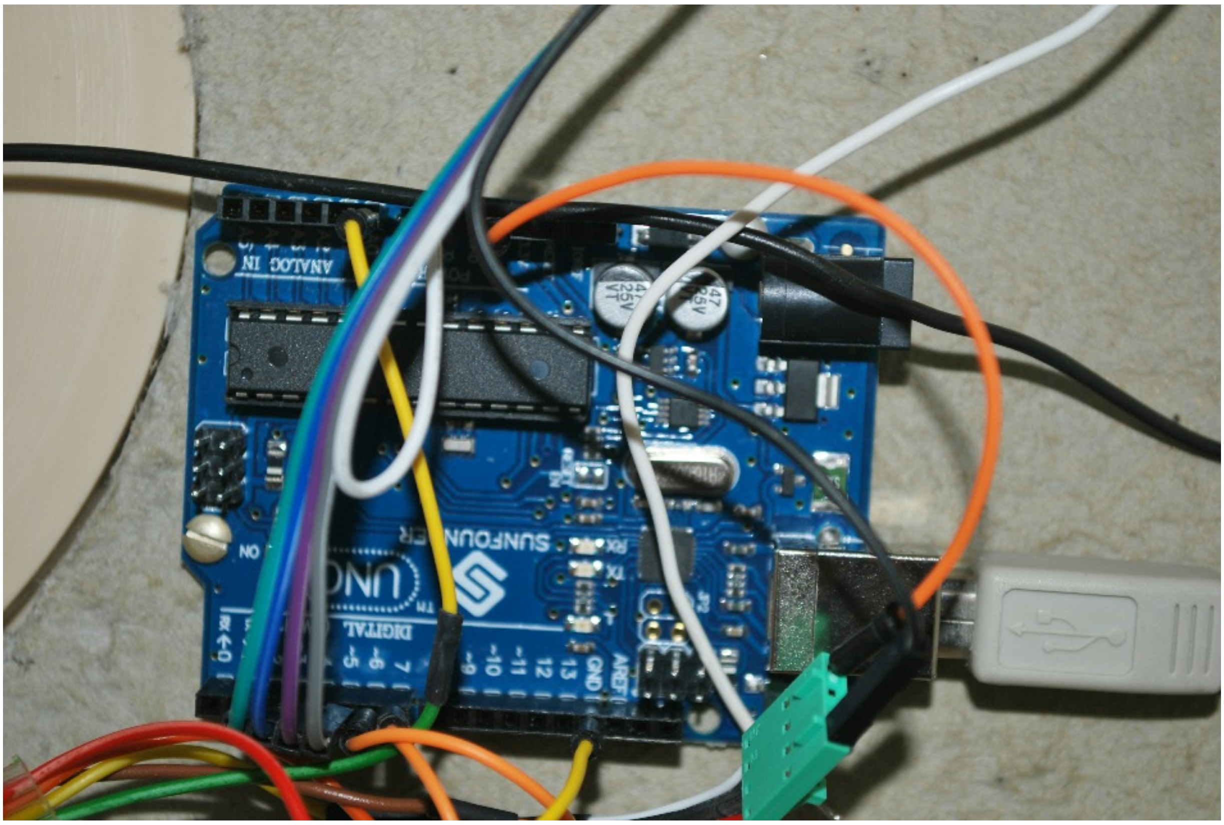


Plug the stepper motor harness into the shield. It only fits one way round.

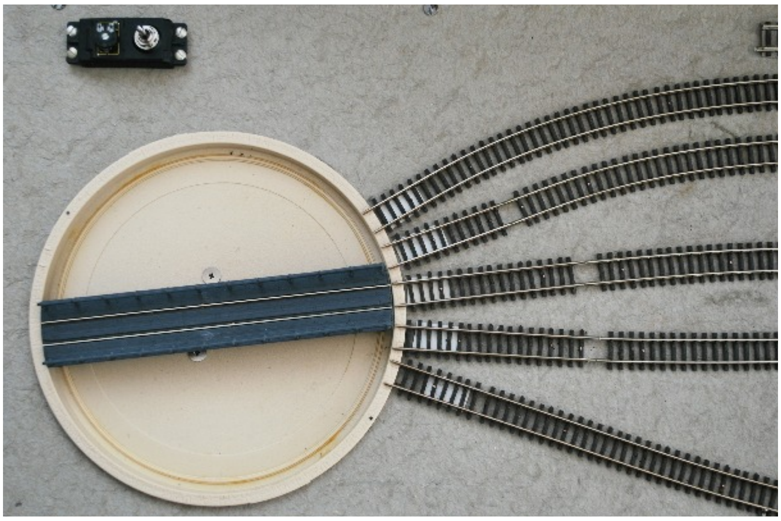
Fitting the units into the layout



The Arduino board and shield have pre-drilled fixing holes which make it easy to screw them into the underside of the baseboard.



Above is the final wiring of the Arduino board



The finished project.

The control panel will hide in a low-relief building once the scenery is completed.

Concluding points

As this article is more to do with model railways than microcontrollers or programming, links for further technical study of these aspects are available from the following web page: www.modeltraincatalogue.com/arduinoproject.html .

Also available from this web page is a video showing the turntable in action and the associated Arduino sketch with a downloadable explanation of how the commands in the sketch operate. It is expected that this project could be developed on by others and this code is offered on a shareable, free, open-architecture basis.

Here is a blow-by-blow procedure to follow to get it working:
1. Download and install the Ardiuno development software from the link on the above web page.
2. Download the file turntable.zip - it contains the Turntable sketch and Stepper.h
3. Extract the turntable control sketch from the zip file - it is called ‘turntable.Ino’.
4. Extract the Stepper.h from the zip file as well.
5. Run the Arduino development software from the shortcut provided by its installation.
6. Select ‘File/Open’ from the menu to load the turntable.ino sketch.
7. Plug in the USB connection to the Arduino board and let the computer ‘find’ it.
8. Upload the sketch to the Arduino and try the controls to see if they work!

The USB cable is powering the board as well as providing the upload channel for the sketch.

There are several ways of powering the Arduino to make it independent of the computer:
A. Use the USB lead (Type A) into a 5v 2A USB charger (e.g. Maplin codes A65LZ or N13KG).
B. Use a 9v-12v DC supply from a controller or similar into the concentric power plug (centre +ve).
C. Construct a regulator device (e.g. LM317) to convert 14v ac (accessory power) to 12v DC.
D. Use six AA batteries in a battery holder using a concentric power plug to fit the Arduino board.

The Arduino board will carry on taking commands from the controls and moving the turntable to the desired position without the need for the computer.

It is worth getting to know these Arduino type devices. They can run several servos that could, typically, open/close crossing gates triggered by oncoming trains, operate semaphore signals, etc. Controlling LED lighting effects is another possibility. The author sees the possibility of one Arduino providing up to six independent DC controllers. I expect Raspberry Pi would do a similar job but that’s another story.

This particular project hardly taxes the Arduino, leaving 6 Digital and 5 Analogue ports completely unused. So there it is, a quiet, controllable turntable for less than the price of a coach. What more could you ask?

I do not expect the magazine staff to deal with queries and advice on the Arduino and programming. So, although I am still learning, I am happy to correspond on this particular project through email: support@modeltraincatalogue.com.